SIEMENS

MULTIMOBIL 2.5

SP

Troubleshooting Guide

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Multimobil 2.5

Med

Service Instructions

Version: 6.0

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7 Service

7.1 Troubleshooting

7.1.1 Tools and measuring instruments required

- Usual service tools
- Digital multimeter
- 2 channel storage oscilloscope with 2 probes and 1 current probe
- mAs meter
- Protective ground wire and leakage current tester: Bender safety tester
- Radiation detector

CAUTION

During Oscilloscope operation the protective ground wire connection in the power cable must not be interrupted under any circumstances.
For measurements where ground loops that may be present could impair the measuring result, use the Tek amplifier and the trigger attachment .

7.2 Control Voltages

Voltage	Measuring Point	Range
+5 V	D915.X15.4	4.8V to 5.2V
+15 V	D915.X15.5	13.5V to 16.5V
-15 V	D915.X15.7	-13.5V to –16.5V
+24 V(For Filament)	D920 X4.7 &4.8	23 V to 25.5 V
Collimator Supply	D920.X12A/B	12V ac to 16V ac

7.3 Signals

Signal	Measuring Point	Range	Adjustment
Kvsoll	D915.TP.KVS During Exposure	2.0 ± 0.1 V for 60kV	D915.P7
Masoll	D915.TP.JRS During Standby	2 V ± 0.1 V for 60kV	D915.P6

Signal	Measuring Point	Range	Adjustment
IH	D915.TP. IH During Standby	2 V ± 0.1 V	D915.P5
	During Preparation	3.8 V ± 0.3 V (For critically damped mA)	
Fmax	D915.TP.REG point during exposure	9.2 kHz ± 0.3 kHz	D915.P4

7.4 HT Check

WARNING

Use Radiation Protection.
Presence of High Tension.

7.5 Calibration

It is advisable to re-calibrate the unit in case of undershoot or overshoot observed in the mA waveshape.
Recalibration is required when the single tank is replaced.

7.5.1 kVp Measurement

The kVp measurement can be carried out either by kVp-meter or by electrical measurement.

7.5.1.1 kVp-meter

Switch the unit ON.
Insert the kV sensor into collimator channel and connect the cable to the meter.
Open collimator flaps such that the sensor is well covered by the field.
Set the kVp meter at 12pulse and 55-85kV range.
Set exposure parameters as 60kV 20mAs.
Release an exposure. The radiation LED will light up during exposure.
The meter will read 57-63kV.
Repeat with meter setting 77-150kV and exposure parameter setting as 90kV 20mAs.
The meter will read 85.5-94.5 kV.

7.5.1.2 Electrical

Connect oscilloscope at D915.TP.KV.
Set the exposure parameters as 60KV 2.5mAs.
Release an exposure.
The recorded waveform will read 2.85 - 3.15V.
Repeat with 90kV 1.6mAs.
The recorded waveform will read 4.27 - 4.75V.
Lower kV indicates error in kVsoll / kVsensing / kV-regulator OR high mA.

Higher kV indicates error in kVsoll / kV sensing / kV regulator.

7.5.2 mA / mAs Measurement

mAs measurement could be carried out either by mAs-meter or by electrical measurement.

7.5.2.1 mAs-meter

Remove mAs link on D920.
Insert mAs-meter leads in the banana sockets mA+ and mA- on D920.
Set meter in the mAs mode at 200mAs.
Set exposure parameters as 60kV 20mAs.
Release an exposure.
The meter will read 19 - 21mAs.
Repeat for exposure parameters 90kV 16mAs.
The meter will read 14.4 to 17.6mAs.
The actual tube current can be measured by setting the meter in mA mode.
Set the exposure parameters as 60kV 50mAs.
Release an exposure.
During the exposure, the meter will read 23 - 27mA.

7.5.2.2 Electrical

Connect oscilloscope at D915.TP.JR.
Set exposure parameters as 60kV 2.5mAs.
Release an exposure.
The recorded waveform will read 1.58 - 1.62V.
The exposure time will be 76 - 84mS.

Lower mA indicates error in mAsoll / mAsensing / mA regulator circuit.
Higher mA indicates error in mAsoll / mA sensing / mA regulator OR Low kV.
Incorrect mAs indicates Error in timer.

7.6 Troubleshooting

In case of CODEs which Impair radiography, perform the following checks.

7.6.1 Checking the line voltage

Measure the supply voltage at site using the digital multimeter.
Ensure that the supply conditions

- Voltage
- Frequency
- Mains Resistance

are within limits as specified in the Technical Specifications for the Unit.
Switch the Unit ON

NOTICE

If the Unit can not be switched ON Check Supply at Socket.Check Continuity of mains cable with the Plug pins.Check Over Current Protective devices MCB and U1 & U2.

Switch the Unit OFF.

7.6.2 Checking the fuses

Open the front cover of the control unit .
Loosen the Fuse carriers which are mounted on the base of the control unit and check the continuity of fuse link . If fuse link has responded for overcurrent replace the Fuse Link.

Checking the fuses on D920

F1	0.25 AT	T1 transformer primary
F2	0.630 AT	240 V for X-ray table.
F3	0.630 AT	24 V for K3,K4,K5 relays
F4	10 AF	Collimator supply
F5	4 AT	Filament circuit.

7.6.3 Checking the LEDs on D920

Switch the Unit ON.
After the initialisation, the default data 60 kV and 10 mAs are displayed at first time switch ON or last stored kV & mAs value.

7.6.3.1 Standby mode

On D920 the following LEDs are illuminated :

V3	Main line voltage 240 V.
V9	Presence of 240V.
V12	Presence of 24 V for relay
V15	Presence of 12 V for collimator
V25	Presence of 24V for filament circuit

7.6.3.2 Preparation ON

On half press of exposure release switch unit should go in preperation mode.
In addition, V22 (green) lights up on D915.

7.6.3.3 Exposure Mode

On the second step of exposure release switch ,unit enters in radiograpy mode.
In addition, V23 (green) for exposure lights up on D915.

7.6.3.4 CODE message

V24 (red) lights up on D915 and CODE no. will be displayed on 7 segment display. This will alternate with the kV and mAs values selected.

7.7 Checking the Control Voltages

When the unit is ON relay K2 on D920 are ON.
SMPS placed in the Inverter module gets supply, Measure the DC voltages at X15 connector of D915 PCB.

Pin No.	Signal Name	Input/Output	max. permissible voltage/current
1	D gnd	Input	0V
2	-nc-	-nc-	-
3	D gnd	Input	0V
4	DC supply	Input	+ 5V
5	DC supply	Input	+15V
6	A gnd	Input	0V
7	DC supply	Input	-15V

-nc- = No Connection

7.7.1 Checking the Intermediate circuit voltage

Depending on the supply voltage, a value between 250 to 350Vdc must be measured with the digital multimeter across the parallel capacitors C1,C2,C6,C7 and C9(if present) in inverter module.

7.8 Checking & setting the maximum main inverter frequency

Turn the Unit OFF.
Place the ST link on D915 so as to short the two terminals.

Make the unit ON. The unit enters SERVICE mode.

In the service mode of the unit ,select Prog 7 by using the KV switches.

On activation of this mode by pressing the DL-serv Key , the display indicates

Adj	F

Press the Radiographic exposure switch and monitor REG on Digital storage Oscilloscope at Reg Test Points.

The display indicates

F	On

And max. Inverter firng frequency will be displayed on Oscilloscope.

Adjust REG for 9.2 kHz ±0.3kHz by using P4 on D915 card

After adjusting the frequency switch off the unit and remove ST link on D915 card .

Fmax= 9.2 ± 0.3 kHz.
Adjust the maximum main inverter frequency with potentiometer P4 on D915
Turn the Unit OFF.
Connect 9 pin D-type connetor on D920 PCB.

7.9 Filament current measurement

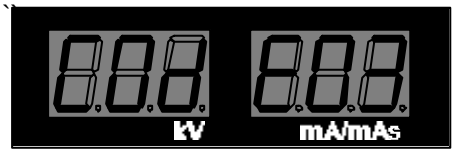
Turn the Unit OFF.
Connect oscilloscope to D915.TP.IH
Turn the Unit ON.
After approx. 3 seconds the Stand-by filament current starts & equal to 2V ± 0.2V
Trigger exposure with default values for kV and mAs.
Observe the change in voltage level from 2 V ± 0.2V to Preheat value approx 3.8V ± 0.3 V.
Note : Preheat value is parameter (kV & mAs) specific. Just observe the change in level on preheating step.

7.10 Checking the high voltage kVsoll and kVist

Connect oscilloscope to D915.TP.KVS & D915.TP.KV
Turn the unit ON.
Trigger an exposure with the default values.
Observe the voltage on C.R.O with the scale corresponding to 1V= 20kV for KV and 1V =30KV for 30 KVS.

7.11 Setting the Maximum filament frequency

Turn the Unit OFF.
Remove X11 D915.
Connect oscilloscope to D915.TP.CAL
Turn the unit ON



Wait for the contactor to pick up.Press the DL_serv key on the D936 twice.
Using P3, set the maximum filament frequency on D915 (1.8 KHz to 2.2 KHz))
Note : Duty Cycle of the waveform is varying as the ON time is fixed.
Turn of the Unit.Replace X11 connector on D915 PCB.

7.12 Checking the tube current

Connect oscilloscope to D915.TP.JRS & D915.TP.JR
Turn the unit ON.
Trigger an exposure with the default values.
Observe the voltage on CRO (1V = 20mA) & confirm value for selected kV & mAs.

7.13 Checking the kV and tube current (JR)

Connect oscilloscope to D915.TP.KV & D915.TP.JR
Turn the unit ON.
Trigger an exposure with the default values.
Observe the voltage on CRO (1V = 20mA & 1V=20kV) for selected kV & mAs .

7.14 Checking the mAs values

Turn the Unit OFF.
Remove the Shorting Link “mAs +/-” on D920 PCB banana sockets.
Connect mAs meter to “mAs +/ mAs-” on D920 PCB.
Turn the Unit ON.
Trigger the following exposures:

Setting at control panel	Valid mAs values
40kV,200 mAs	190..210 mAs
66kV,100mAs	95...105 mAs
90kV,1mAs	0.9.....1.1mAs

Turn the Unit OFF.
Remove the mAs meter and reinsert the Link on the D920 PCB.

7.15 Adjusting the mAs

Turn the Unit OFF.
Remove the Shorting Link “mAs +/-” on D920 PCB banana sockets.
Connect mAs meter to “mAs +/ mAs-” on D920 PCB.
Turn the unit ON.
Trigger the exposures for default kv & mAs settings.
Observe the mAs meter reading and if it is not within the tolerance (specified in the Technical Specifications) of set value adjust the P1 on D915 card

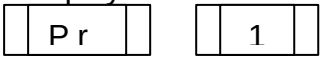
7.16 Switching the Collimator Light ON

Switch ON Collimator Lamp. The Halogen lamp will light up and field of light will appear on the target. The lamp will be switched OFF automatically after 30 seconds.

If the collimator lamp is switched ON and OFF several times within a short period, overload protection will automatically switch the light OFF. Cool-down periods are recommended.

7.17 Program Modes for servicing.

To put the Unit into service Mode short the ST link on the D915 and turn ON the unit .The display will show as follows



Use the KV + or KV – switch to move to any program (PR 1 to PR7)

Use the DL_Serv switch on the D936 to to select the displayed program.

7.17.1 Program 1

Not Used

1. Short the ST link on the D915 and put the unit on .

the display will read as below and enter program mode .

Pr	1

2. This program is not used

7.17.2 Program 2

To check the total number of exposures taken .

1.The display on the D932 will be as below.

XXX	XXX

XXX XXX corresponds to the total number of exposures taken on the unit.

7.17.3 Program 3

To check the type of codes that occurred in the unit (maximum 20) .

1.Press the switch DL-serv on the D936 once.The display will be

AA	XX

AA diplays the serial number of the exposures that have occured, in chronological order (max. 20) & XX displays the corresponding codes occured on the unit

7.17.4 Program 4

To erase the codes that occurred in the unit

1.Press the switch DL-serv on the D936 once.The display will be

ErA	Err

Keep the mAS – key depressed for 4 seconds till the dislay beomes

0	Err

7.17.5 Program 5

To store the Last Value of KV & mAS Display

LAS	VAL

By entering into this program the last value displayed before turning OFF the Unit will be displayed on turn it On the next time .

7.17.6 Program 6

To Display the maimum KV & mAS possible with the Unit

100	200

100 indicates the maximum KV available & 200 indicates the maximum mAS

available on the Unit

*In case the display values do not vary in standby by using the key PCB then

Enter this program and vary the KV & mAs displayed using the Key PCB D936

Then switch the the Unit OFF and enter standby mode, the unit should function normally .

7.17.7 Program 7

Adjusting REG frequency.

Please refer chapter 7.8 (Checking & setting the maximum main inverter frequency)

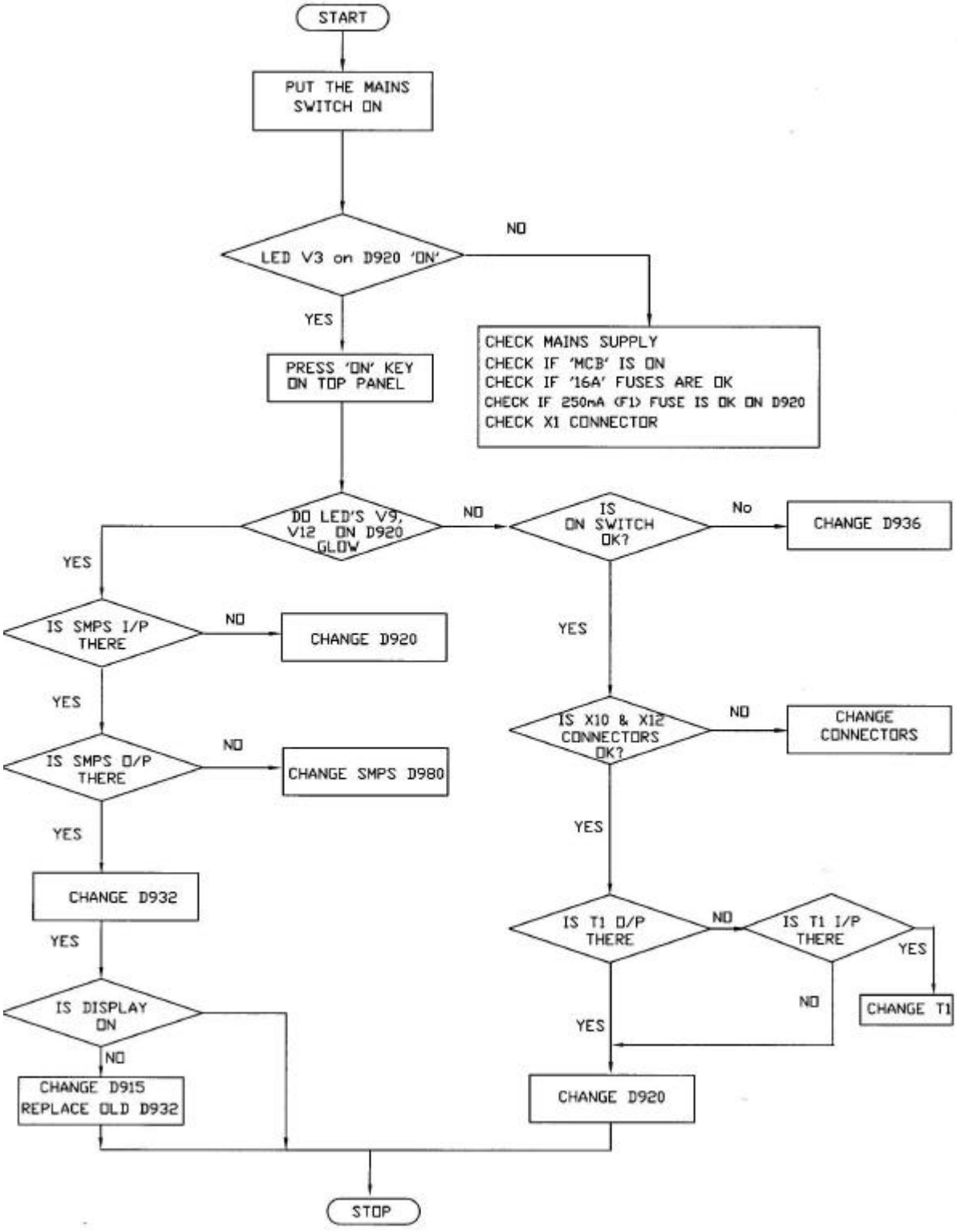
7.18 CODEs

Initialisation Codes		
90	EPROM Checksum Failure	The EPROM Checksum is stored at 7FFEh and 7FFFh as a 16 bit word. During self Diagnostics the software calculates the checksum of the EPROM and compares with the stored checksum.
96	kVsoll Failure	During Self Diagnostics the software outputs 7Fh to the D/A converter (B). The 2.5V at the output of the D/A converter is Read by the µC through Analog Port 4. The value read should be greater than 7Ah and less than 86h. (I.e. between 2.39V and 2.62V)
97	JRS Failure	During Self Diagnostics the software outputs 7Fh to the D/A converter (A). The 2.5V at the output of the D/A converter is Read by the µC through Analog Port 3. The value read should be greater than 7Ah and less than 86h. (I.e. between 2.39V and 2.62V)
99	Last Reset by watchdog Timer	The built-in Watchdog timer (WDT) is reset by the software every 25 msec. If due to some failure the software doesn't reset the WDT, the WDT in turn will reset the µC after 65 msec.
Standby CODEs		
02	+15V Supply error	The +15V supply from SMPS is polled by the µC through Analog port 0. The +15V supply should be between +12V to +18V.
03	Iheiz < Istby	The Filament Standby current is 2A. Iheiz read by the µC through Analog port 2 should be greater than 1.75A. i.e. 1.75V (Iheiz ratio : 1V = 1A)
04	Iheiz > Istby	The maximum value of Standby current permitted is 2.2 A.
05	kVist <> 0	kVist is read by the µC through Analog port 7. During Standby the value of kVist read should be Zero. (kVist ratio : 1 V = 20kV)
06	JR <> 0	JR is read by the µC through Analog port 1. During Standby the value of JR read should be Zero. (JR ratio : 1 V = 20mA)
33	Main Inverter Short Circuit	In standby mode if the Main Inverter Driver (Cable) is disconnected this CODE gets activated.
Exposure CODEs		
11	Main Inverter Short Circuit	This CODE is displayed when short circuit is detected by the drivers of the Main Inverter.
12	kVist > kVmax	The PkV is monitored for Max.110kV. If the actual value of kV is greater than this i.e. if the voltage cross 3.73V CODE is displayed.
13	Iheiz > Imax OR JR > Jrmax	Maximum value of Iheiz above which CODE will be displayed is 4.4 A (4.4V). Maximum value of mAist above which CODE is displayed is 71mA. (3.59V)
14	kVist < kVsoll	kVist is continuously polled during exposure. The value of kVist should be greater than 85% of kVsoll
15	JR < JRS	JR is continuously polled during exposure. The value of JR should be greater than 50% of JRS.
17	Backup Timer	This CODE is displayed if regular means of terminating exposure fails and exposure gets terminated by the backup timer. Exposure time is set for (Exp + Exp/4) for less than 100 ms and (Exp +Exp/10) for greater than 100 ms
18	Premature Exposure Termination	Exposure Release Switch is released before the exposure is terminated by the mAs Integrator.

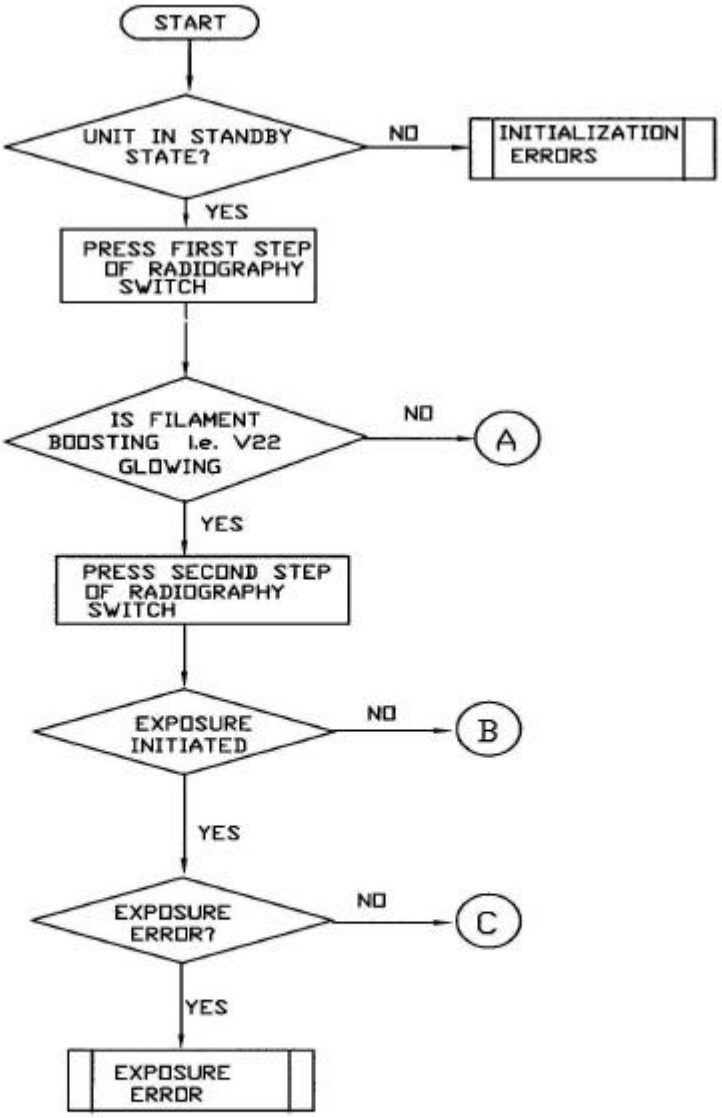
21	I > Iheiz	This CODE is displayed if the filament current exceeds 4.1V in prepation state.
22	Maximum Preparation Time	This CODE is displayed if First step is pressed for more than 15 sec.

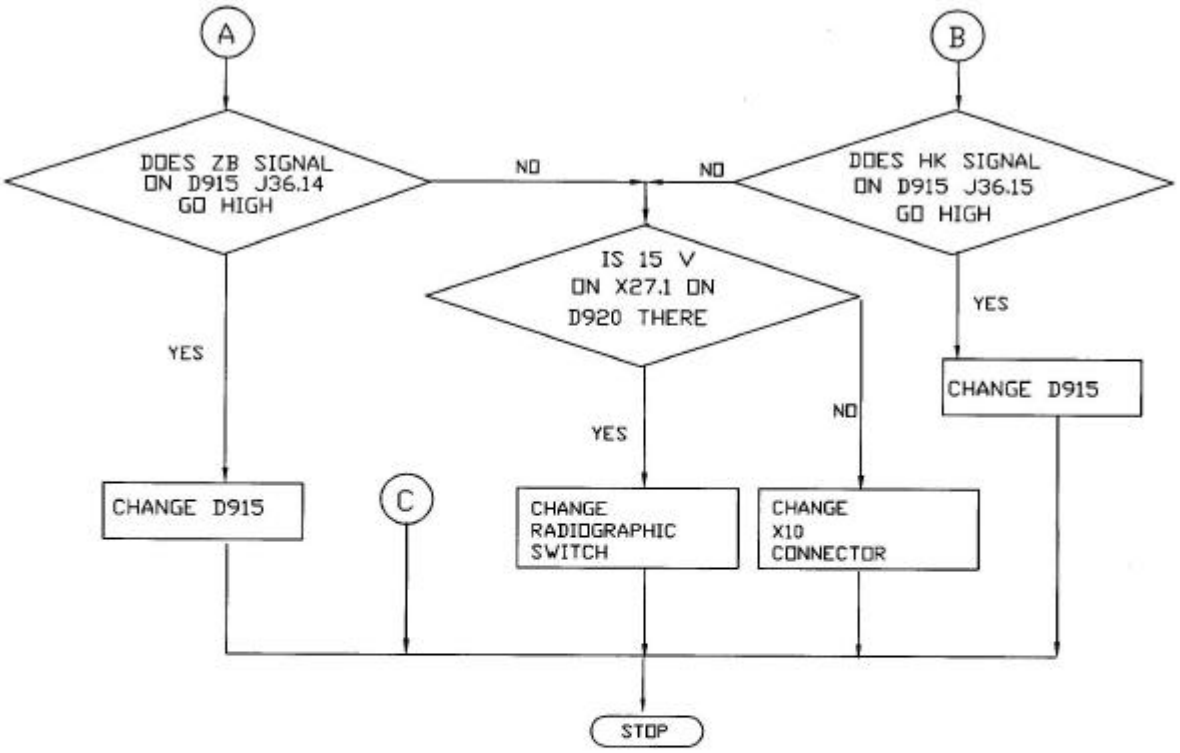
7.19 Specific CODE Handling

7.19.1 Unit not turning ON

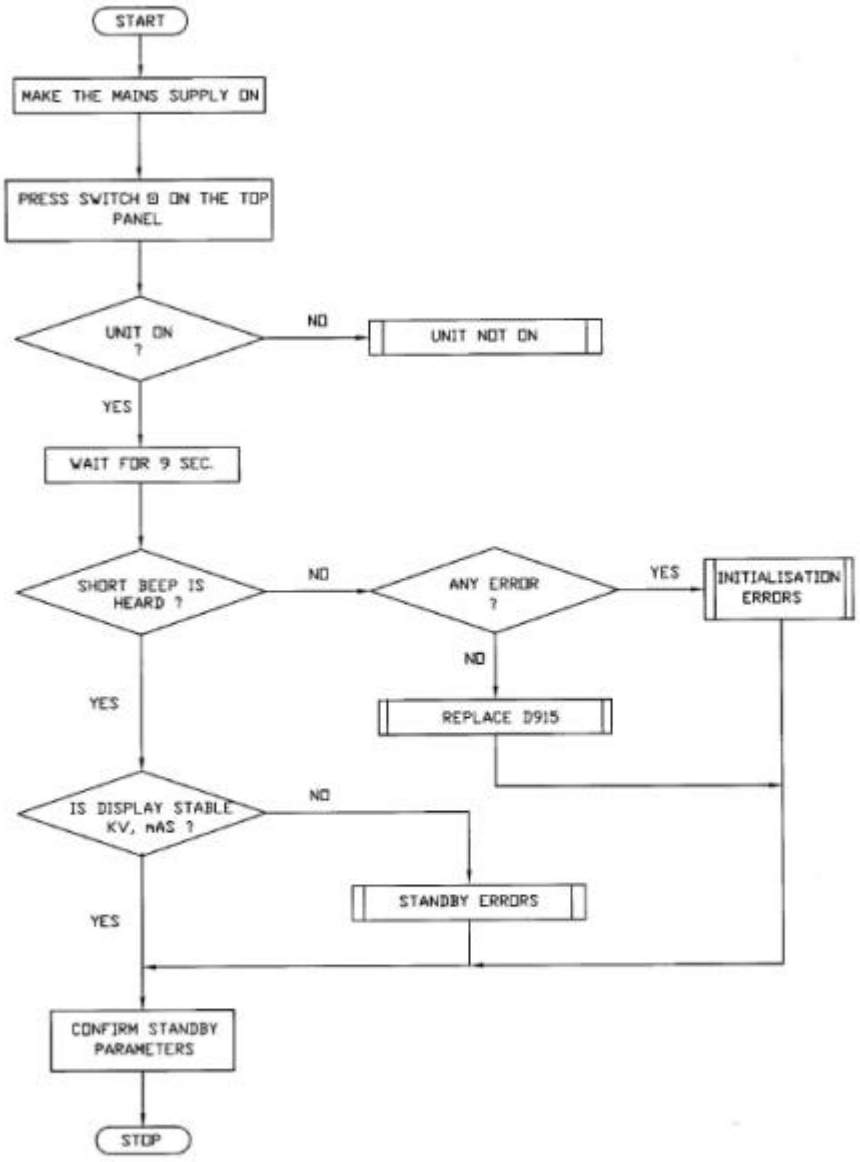


7.19.2 No Radiography





7.19.3 No Standby



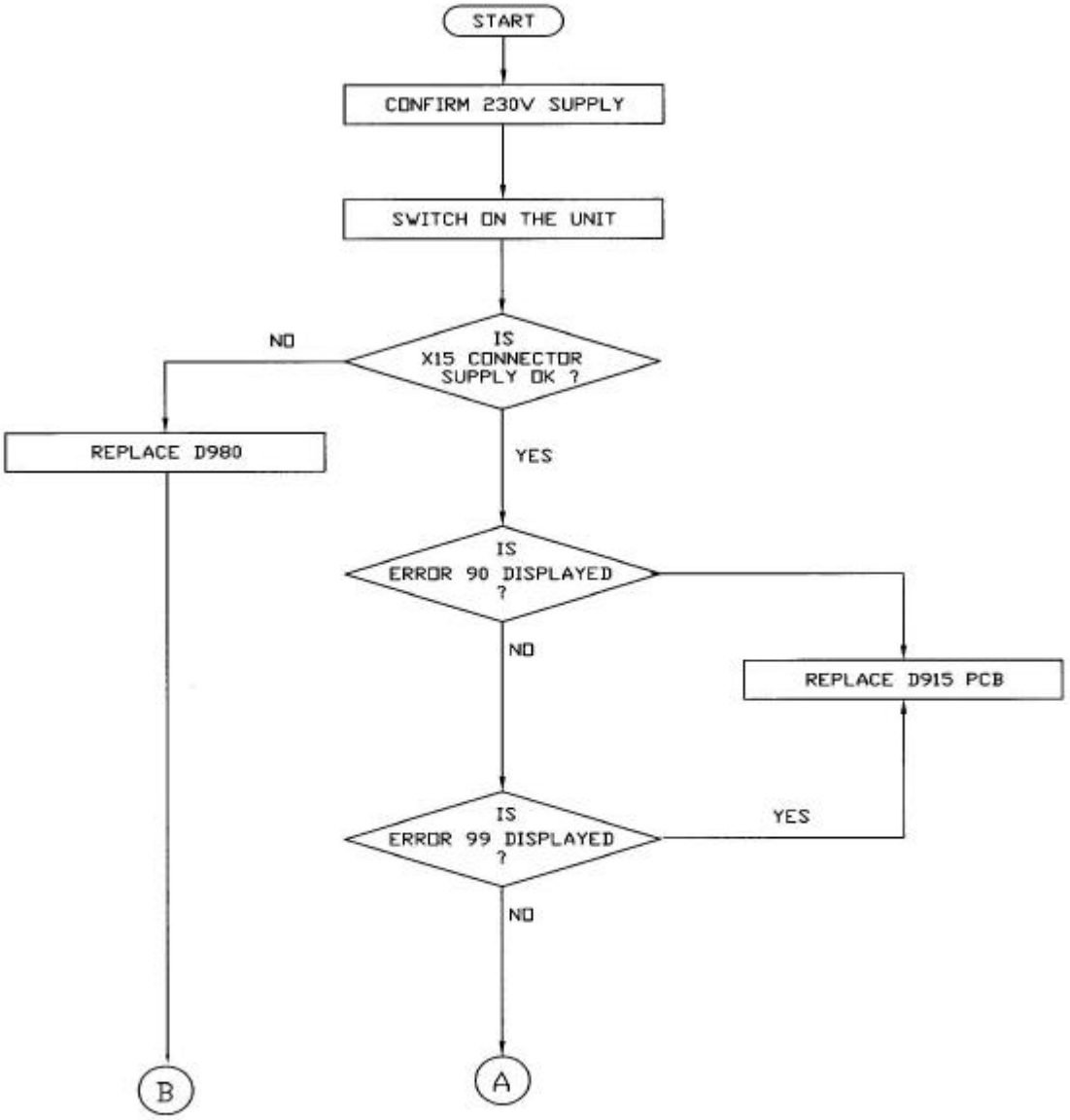
7.19.4 Initialisation CODEs

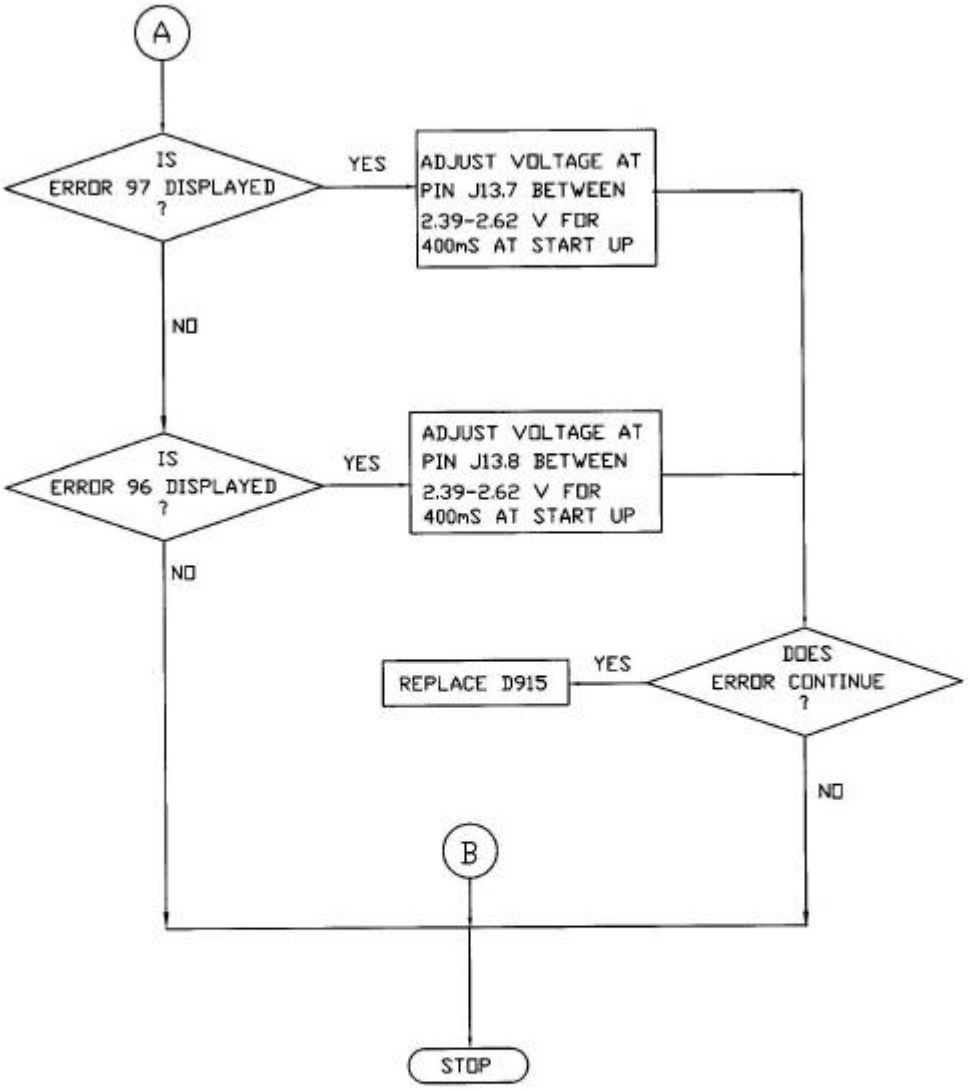
CODE 90 (EPROM CHECKSUM FAILURE)

CODE 96 (KV SOLL FAILURE)

CODE 97 (mA FAILURE)

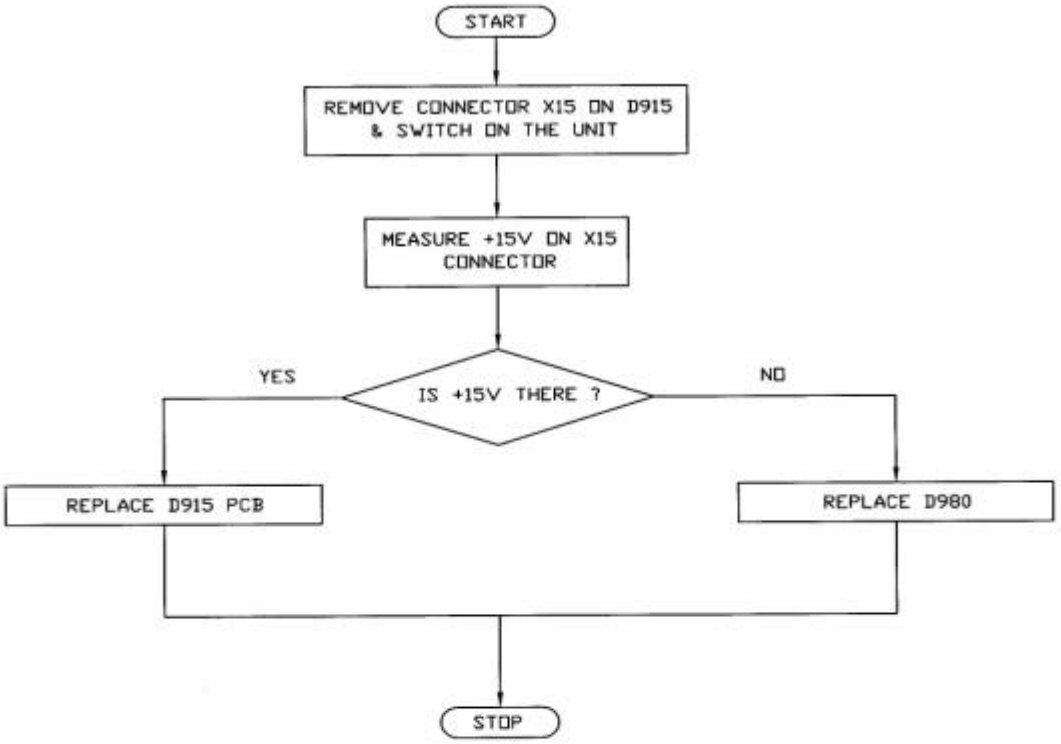
CODE 99 (LAST RESET BY WATCH DOG TIMER)



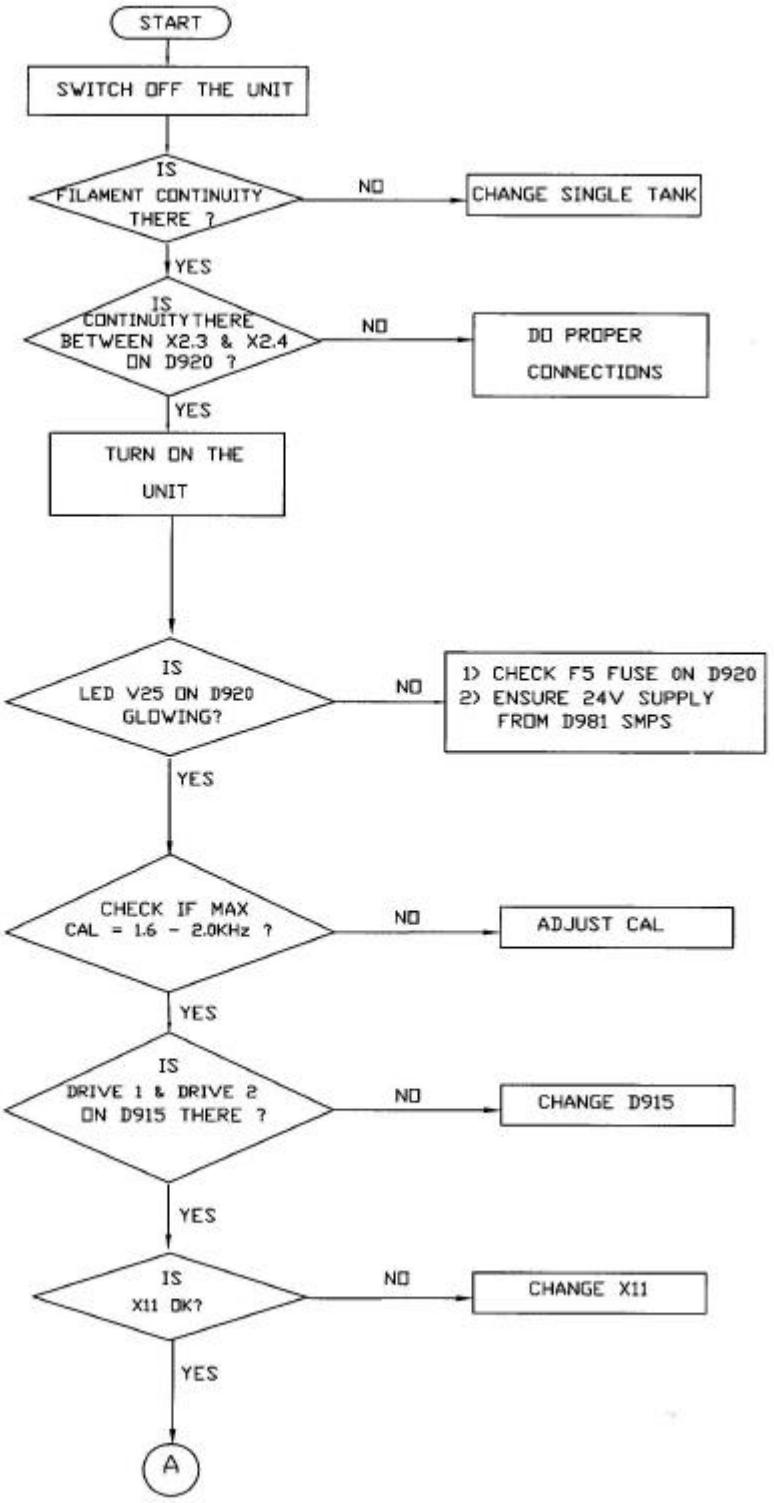


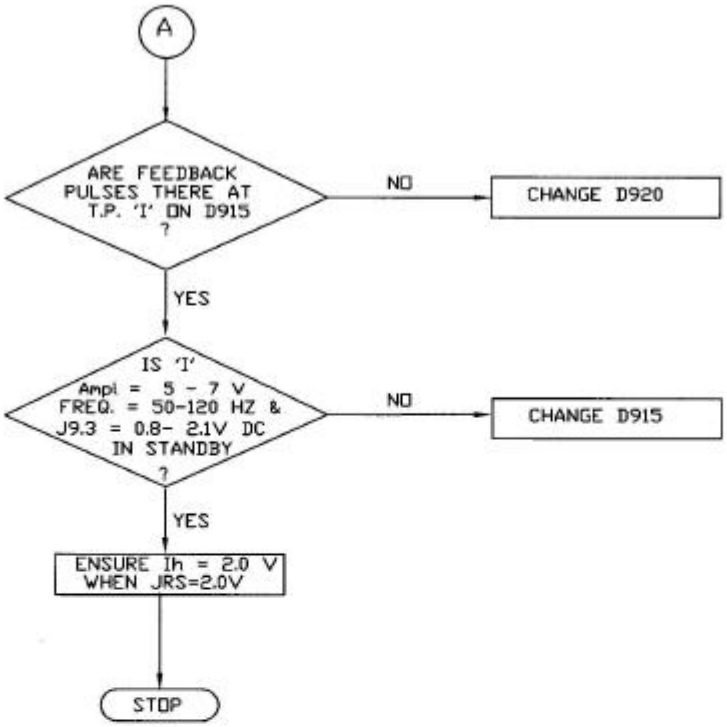
7.19.5 Standby CODEs

7.19.5.1 CODE 02 : +15 V Supply CODE

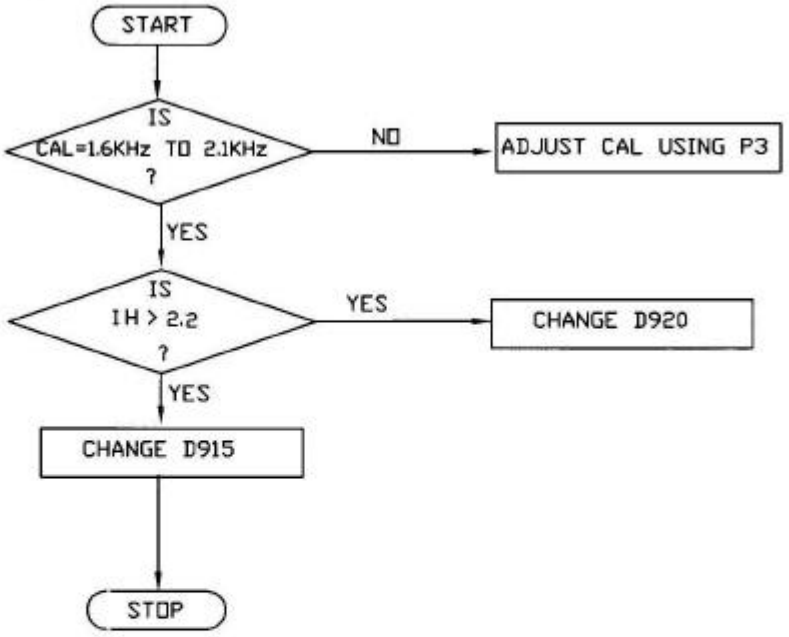


7.19.5.2 CODE 03: Iheiz < Istby

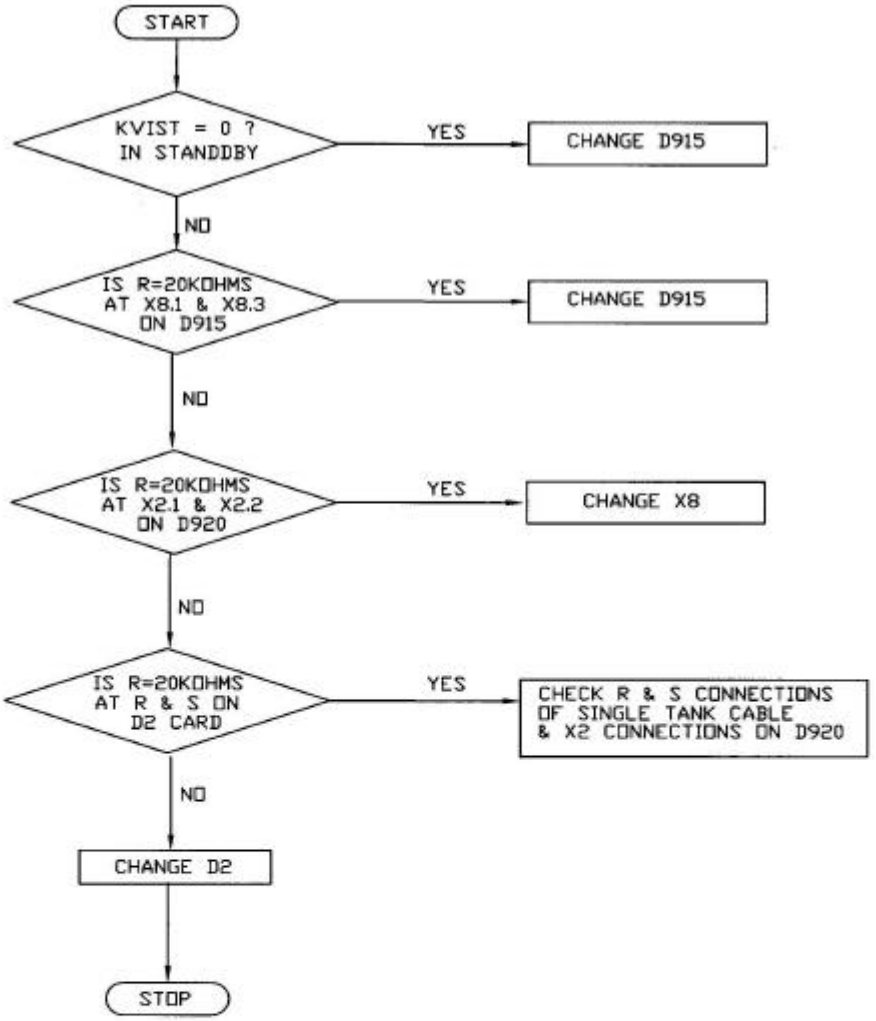




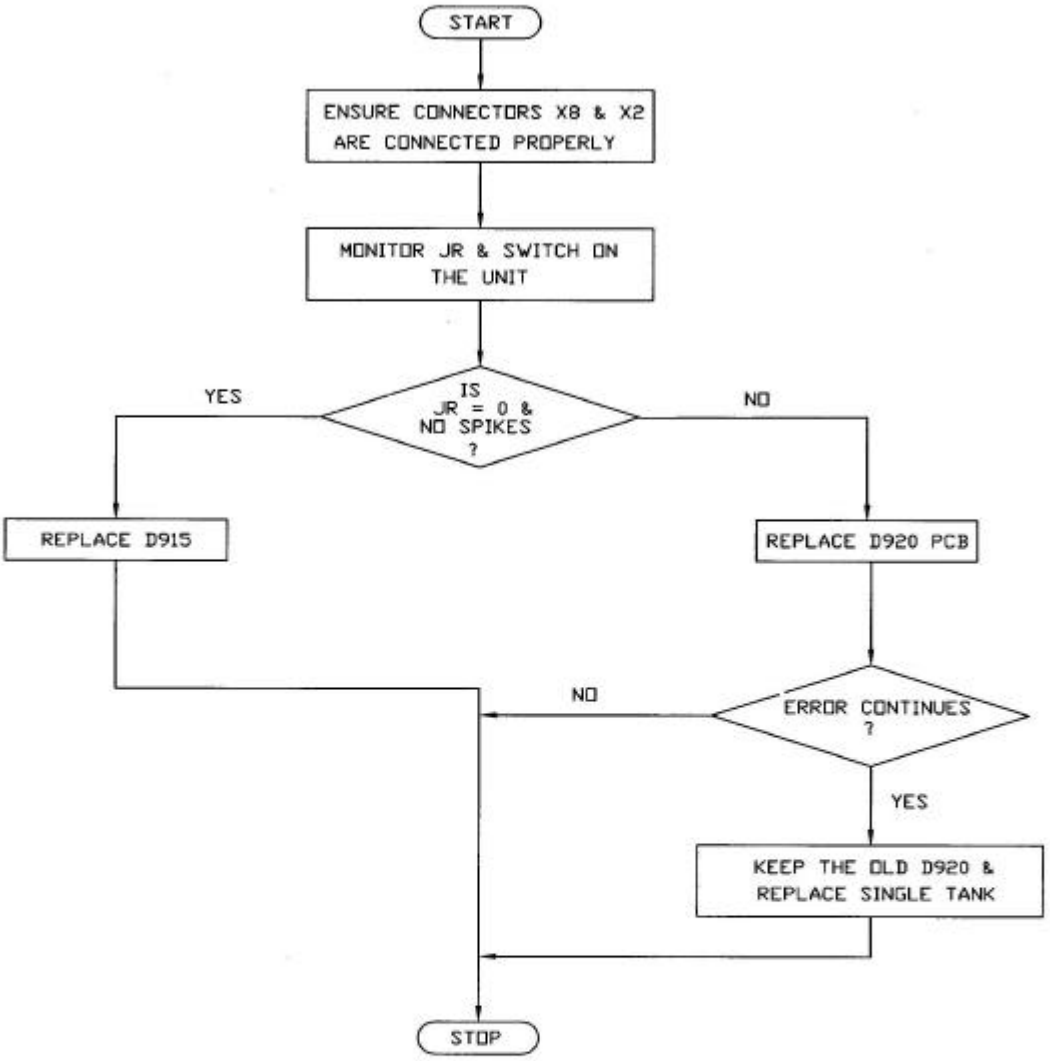
7.19.5.3 CODE 04: Iheiz > Istby



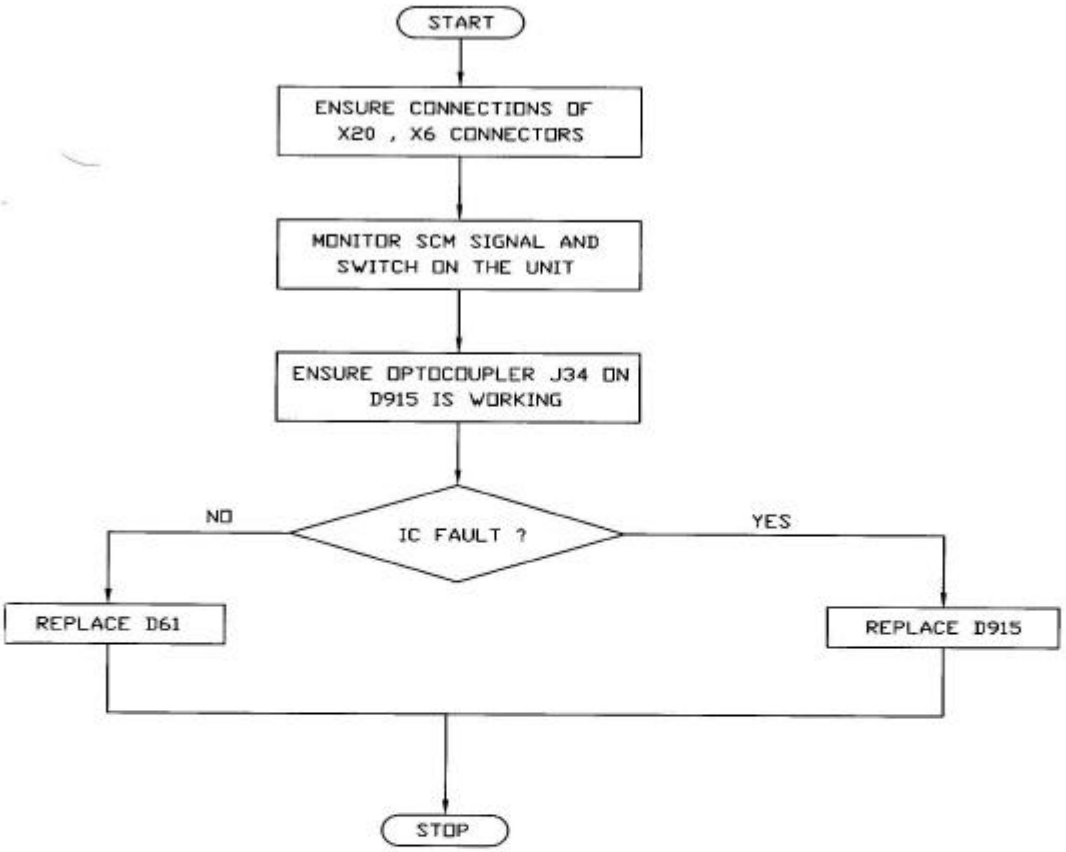
7.19.5.4 CODE 05 : kVist <> 0



7.19.5.5 CODE 06 : JR <> 0

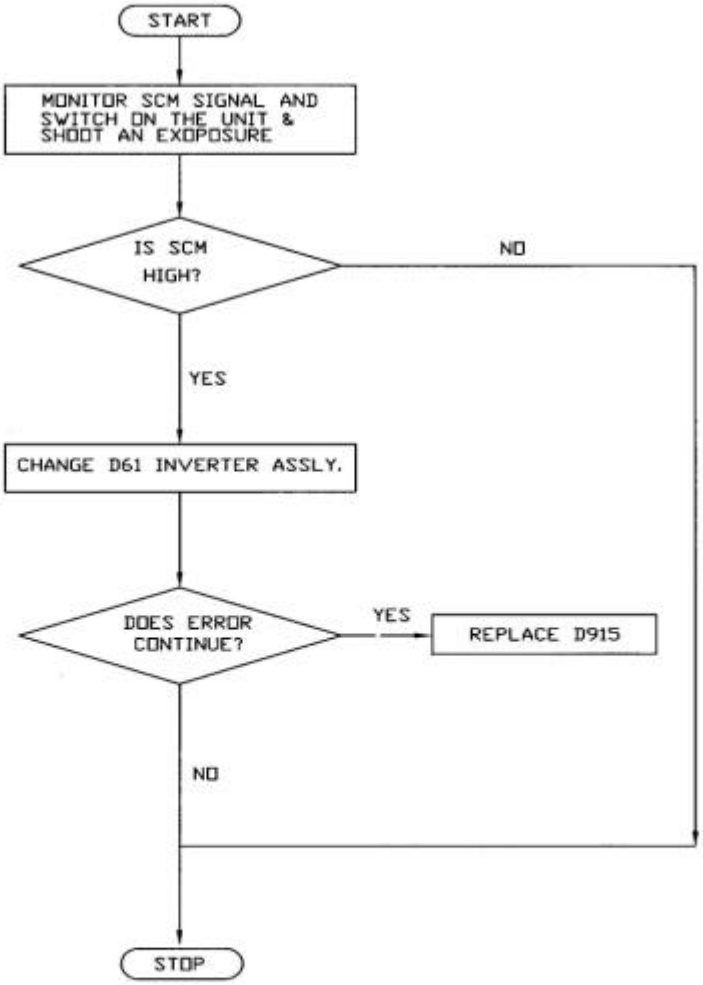


7.19.5.6 CODE 33 : Main Inverter Short Circuit

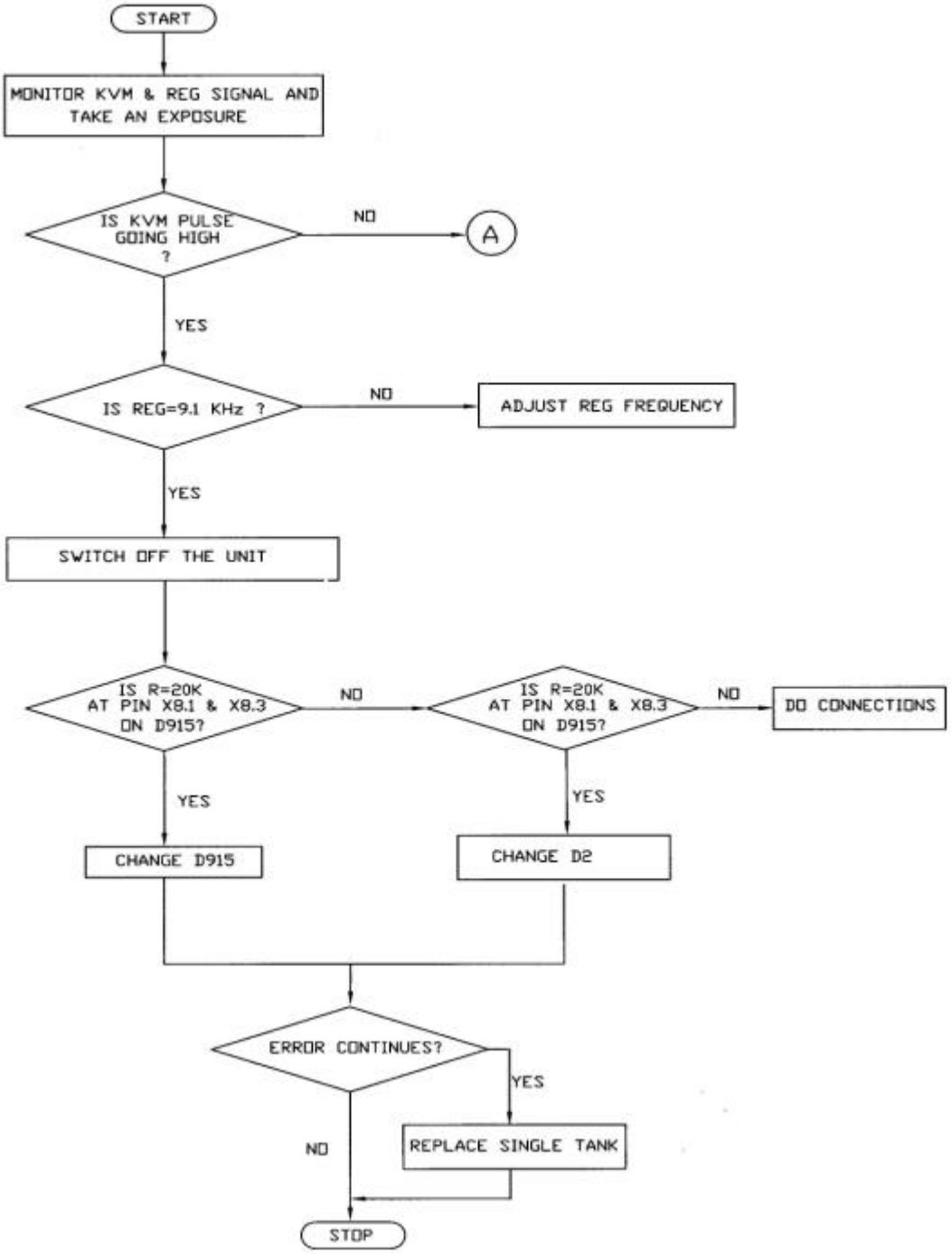


7.19.6 EXPOSURE CODES

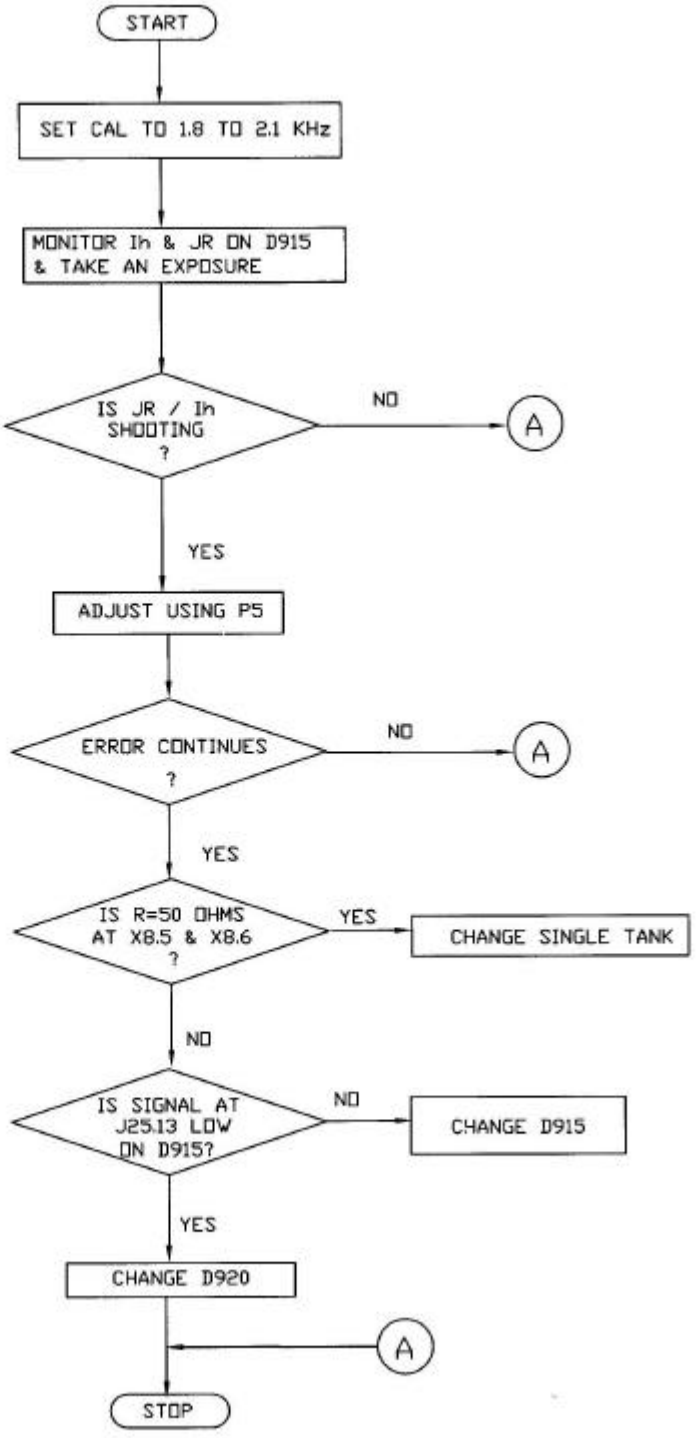
7.19.6.1 CODE 11 : Main Inverter Short Circuit



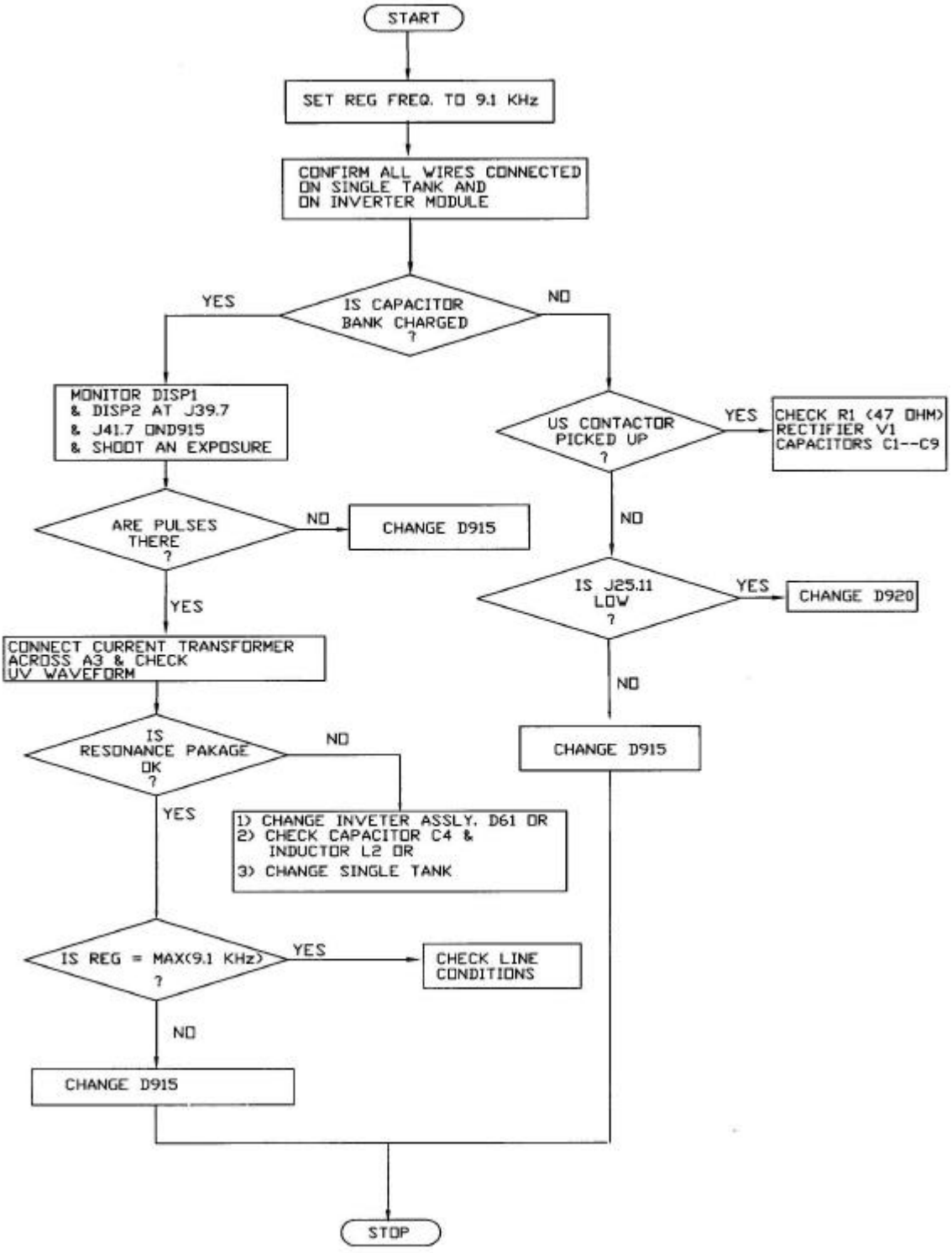
7.19.6.2 CODE 12 : kVist > kVmax



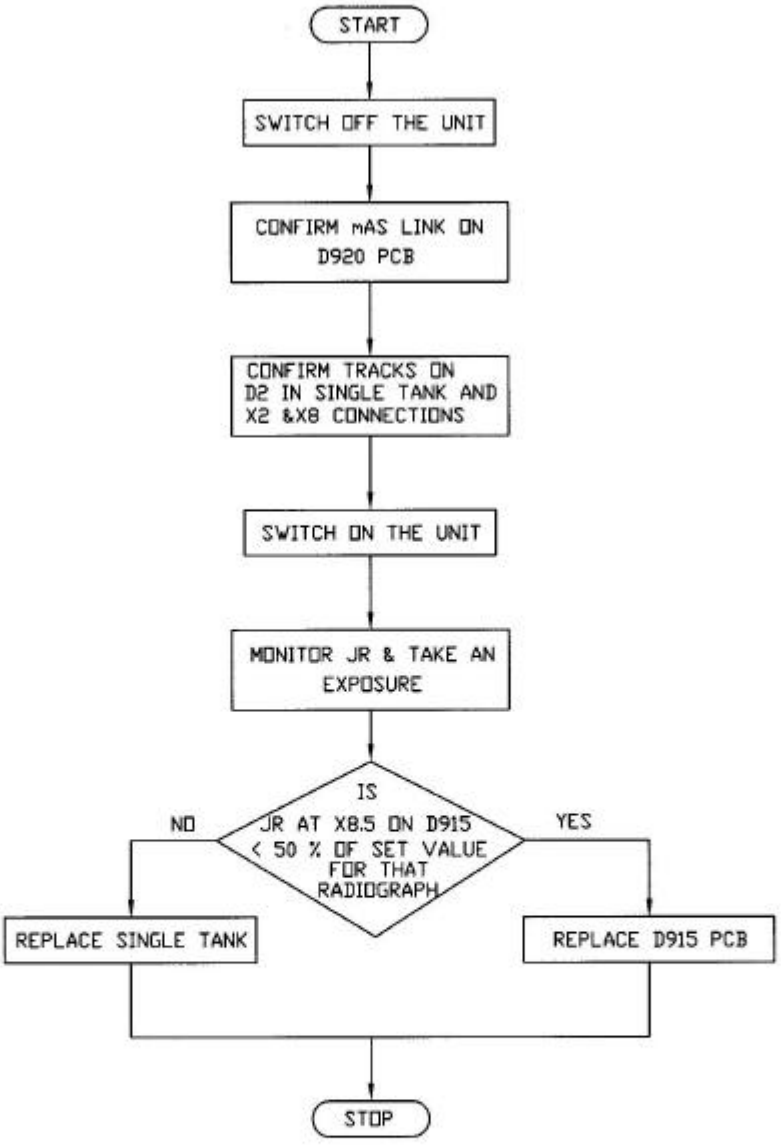
7.19.6.3 CODE 13 : Iheiz > Imax OR JR > Jrmax



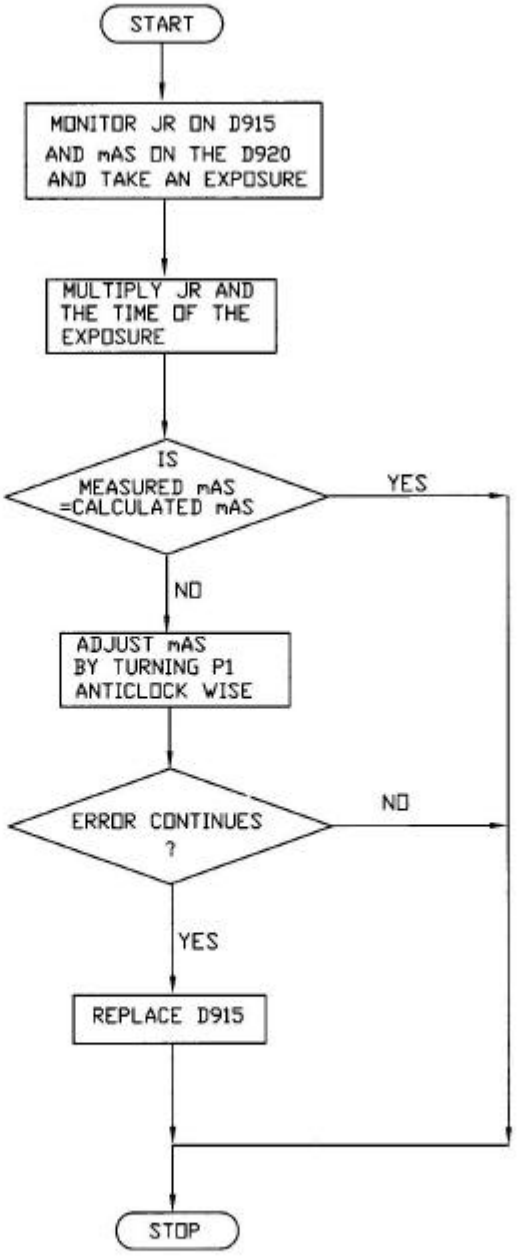
7.19.6.4 CODE 14 : kVist < kVsoll



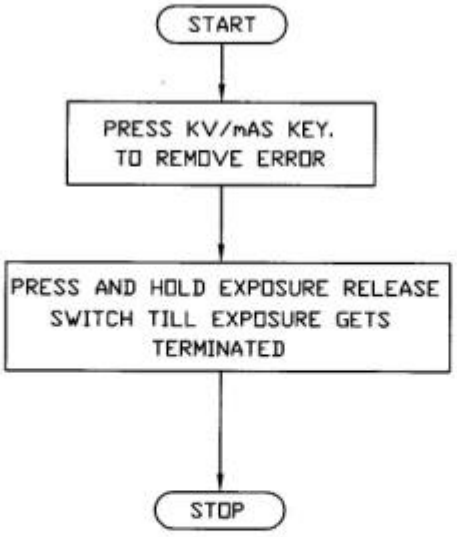
7.19.6.5 CODE 15 : JR < JRS



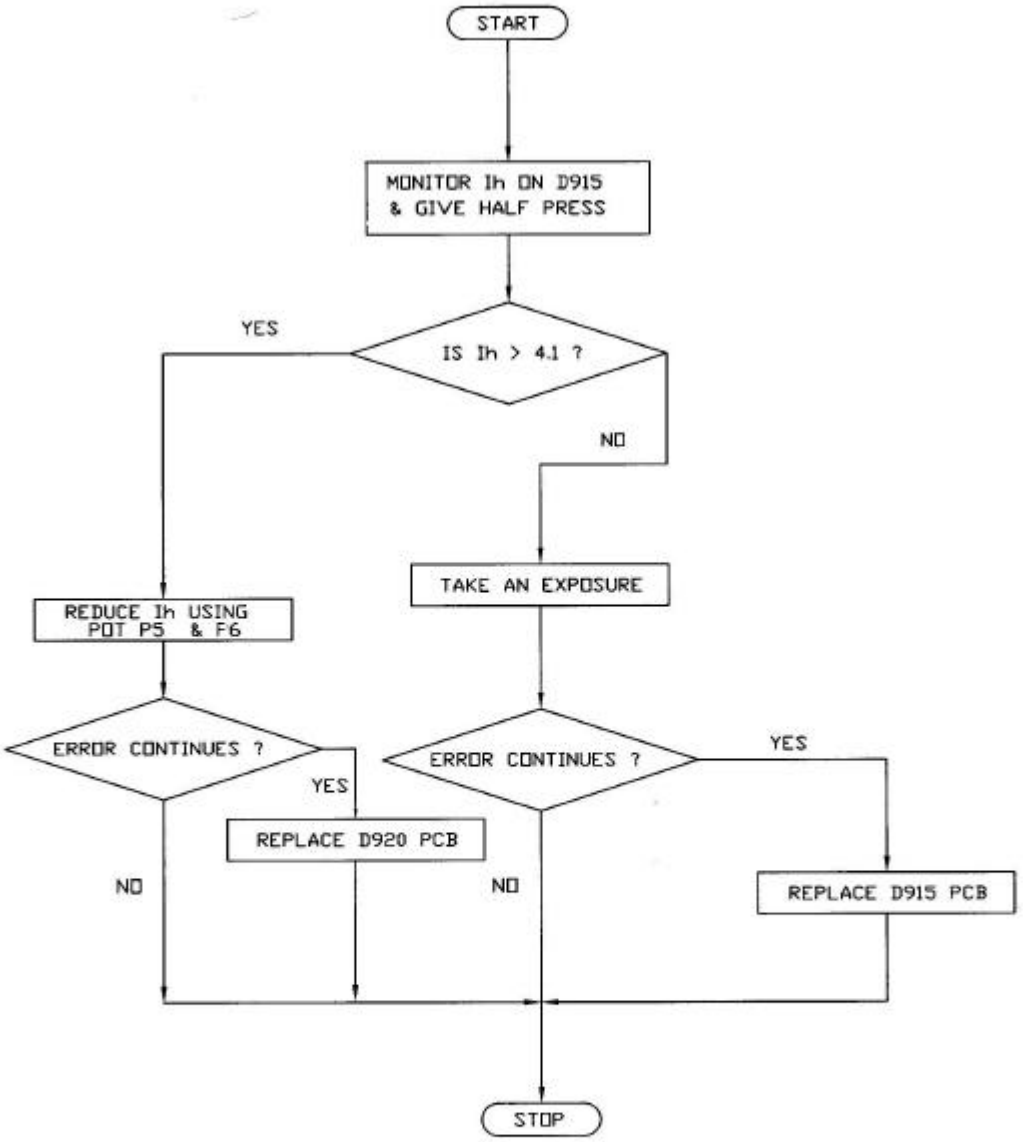
7.19.6.6 CODE 17 : Exposure terminated by Backup Timer



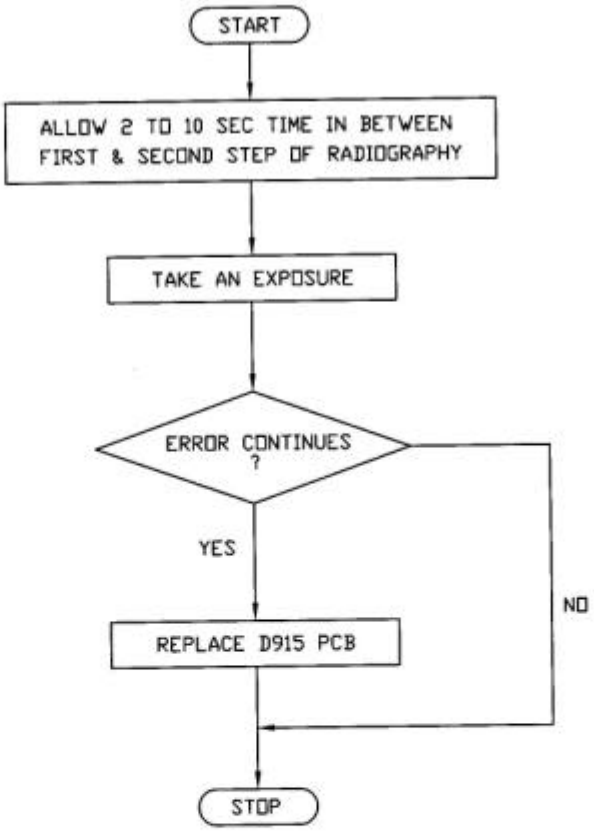
7.19.6.7 CODE 18 : Premature termination of Exposure



7.19.6.8 CODE 21 : Iheiz > Iheiz maximum

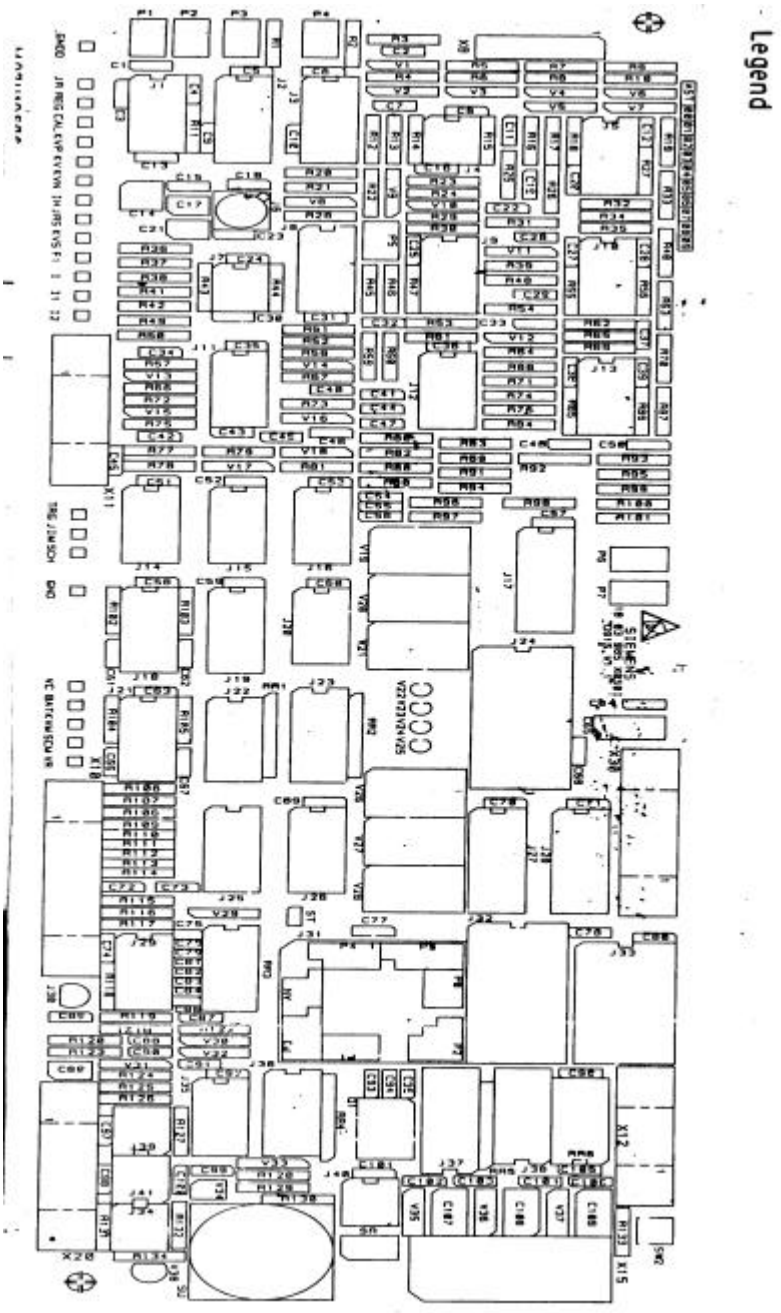


7.19.6.9 CODE 22 : Maximum Preparation Time

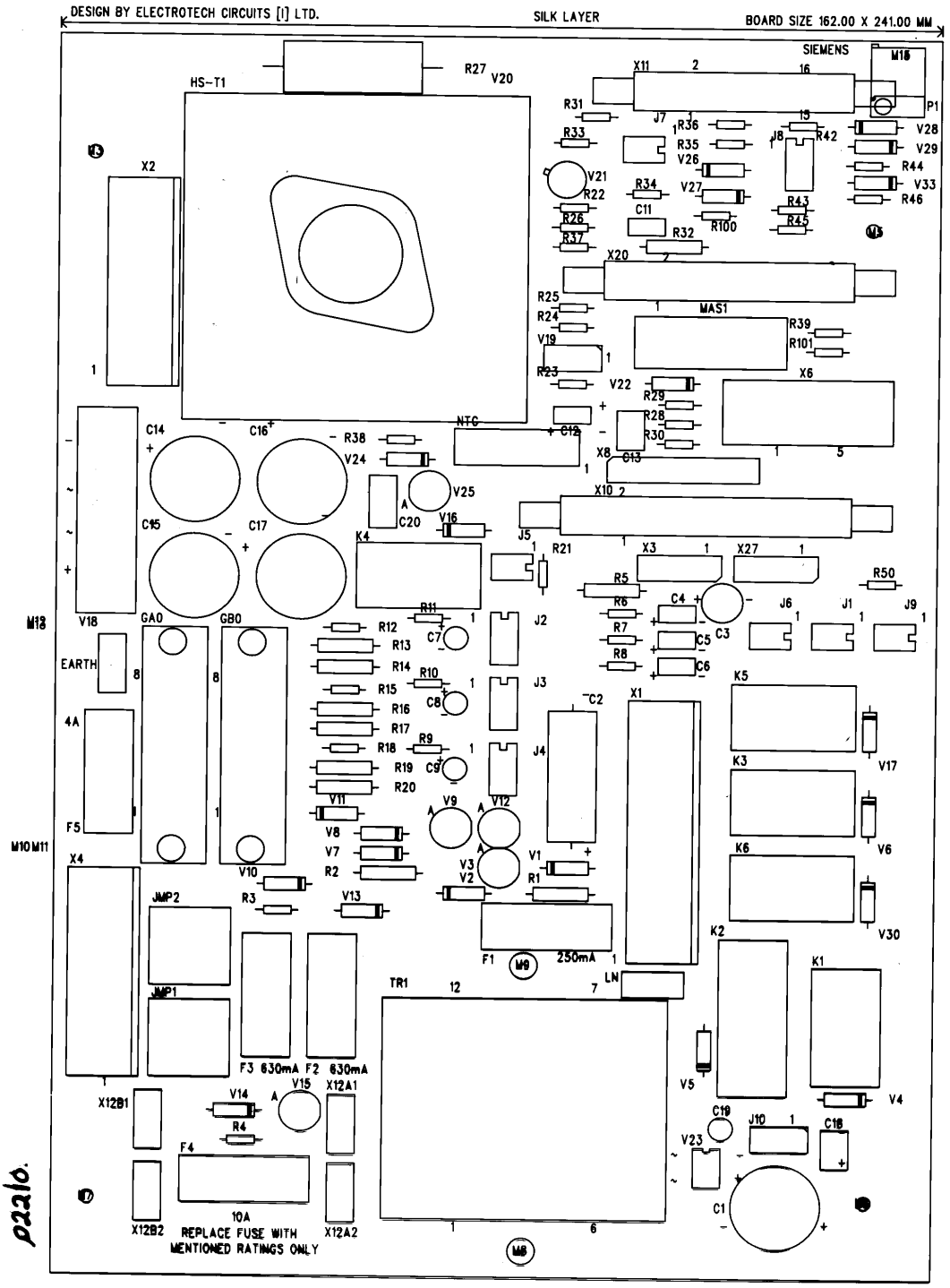


7.20 PCB Layout Drawings

7.20.1 Master Card D915



7.20.2 Interface PCB D920



7.20.3 Inverter Card D61